

**Report of the**

**AD HOC WELLHEAD PROTECTION**  
**ADVISORY COMMITTEE**

**June 1991**

## **PREFACE**

### **A. Wellhead Protection: A Brief Definition**

A wellhead protection area consists of land in the vicinity of a public water supply well chosen for special protection to prevent pollution of the groundwater by nearby surface and sub-surface activities. Public wells include community wells - both those owned by governments and those owned privately - serving regular customers and a variety of wells serving the public in locations such as restaurants, schools and industry.

The size of the protection area is a function of the hydrogeology in the vicinity of the well, its daily withdrawal rate, land use activities existing or likely in the area, and assessment of replacement or other options if the well were to become polluted. The area could range from a few acres to a square mile or more.

The special protection measures which could be applied to a wellhead protection area include zoning limitations on the types of land uses allowed, performance standards to contain and manage potential pollutants, contingency plans for accidents, and coordination among local, state and federal governments and private property owners.

The Safe Drinking Water Act amendment of 1986 (Section 1428) establishes a federal program for wellhead protection under the Environmental Protection Agency and calls on states to develop programs that respond both to the federal guidelines and to local conditions which can be highly diverse. Local governments are essential participants because of their authority over land use and because of local government's role as a utility supplying public water needs. Wellhead protection is one part of an overall groundwater resource protection strategy.

### **B. The Ad Hoc Wellhead Protection Advisory Committee**

The Ad Hoc Wellhead Protection Advisory Committee was established to offer a local government perspective on wellhead protection to the state's inter-agency Groundwater Protection Steering Committee, to local governments and to others. Of interest are questions related to the legal authority for localities to use planning, zoning and other tools for wellhead protection; obstacles which might impede the

exercise of this authority; and recommendations for localities and for the state.

The Ad Hoc Wellhead Advisory Committee consists of individuals involved with and knowledgeable about local government, land use planning and public water supplies plus state agency representatives from several Steering Committee agencies. The members of the Committee are serving as individuals and have not been asked to speak for their employers. In making up the Committee, a variety of factors - geographic diversity, a range of population sizes and reliance on groundwater - were considered. The following persons make up the local members of the Committee.

Chris Dawson  
Robert Dowd  
Terry Harrington  
Ron Hachey  
Doug James  
Bill Veno  
Wayne Weikel  
Haywood Wigglesworth

James City County  
West Piedmont PDC  
Roanoke County  
Botetourt County  
Prince William County  
Rockingham County  
Town of Fincastle (formerly)  
Henrico County

State agency representation on the Committee is provided by:

Terry Wagner  
Bob Taylor  
John Knight  
John Marling  
Ray Utz

Water Control Board  
Department of Health  
Dept. of Housing & Community Develop.  
Council on the Environment  
Chesapeake Bay Local  
Assistance Department

Staff assistance was provided by the Institute for Environmental Negotiation (A. Bruce Dotson, Elizabeth Waters and Jeryl Rose) of the University of Virginia.

The Committee has met six times between December 1990 and June 1991 and has undertaken to acquaint itself with wellhead protection as envisioned by the Safe Drinking Water Act and by EPA and as practiced in communities in other states. The Committee has explored technical topics such as the state's hydrogeology and grappled with the issues this poses for delineating precise protection areas. The Committee has examined the roles, authority and resources of Virginia's local

governments as well as our state agencies. A great deal has been learned with the time and resources available.

This paper reports the Committee's findings and recommendations. We hope that this report represents a beginning and that momentum for wellhead protection will grow in Virginia.

## **EXECUTIVE SUMMARY**

The Ad Hoc Wellhead Protection Advisory Committee submits this report of its findings and recommendations regarding the legal authority for localities in Virginia to use planning, zoning and other tools for wellhead protection; obstacles which now impede widespread adoption of wellhead protection measures; and our recommendations for needed actions.

Our most important findings are that Virginia localities have a need for wellhead protection and that authority does exist to use planning and zoning to establish local wellhead protection programs. Chapter 15.1, Article 4 and 8 were amended in 1988 and in 1990 to make groundwater protection an authorized purpose of planning and zoning.

However, we also find that a number of significant obstacles currently exist to fully utilizing this authority:

- public awareness of the potential problem and widespread support for wellhead protection have not yet developed
- Virginia's localities are both politically and physically diverse with the result that no one approach will work best statewide
- since wellhead protection is largely untried by Virginia localities, models and examples need to be drawn from other states
- a case can be made that wellhead protection is cost effective, but few Virginia localities have assessed their local situation to identify their particular risks and the options they could pursue in the event of a pollution problem
- data needed to document problems and to provide a basis for delineating areas to be protected is not currently readily accessible

To address these issues, we recommend a two stage approach. While there are a number of potential advantages to enacting laws in Virginia that would make wellhead protection mandatory, there are also questions about the timeliness of such an approach. The base of public awareness and support, the availability of important data, development of needed technical capability and the funding necessary for undertaking a mandatory statewide program are not present at this time. Therefore, we recommend a strategy focused on a voluntary program of local wellhead protection while the base of necessary support of all types is being built for a possibly more extensive mandatory program in the future.

We recognize that the state, the Groundwater Protection Steering Committee, the Water Control Board, the Health Department and others, have greater technical expertise, data access and overall leadership in groundwater protection than local governments. Therefore we recommend that the state take the initiative in placing wellhead protection on the public agenda and use their resources to build capacity both within state government and at the local government level. We recommend more specifically that the state

- prepare, distribute and organize discussions around a report that might be titled "Wellhead Protection: Tools for Local Government in Virginia." This report should be a primer on wellhead protection, present models and examples of tools that might be adopted, and describe assistance and reference materials available to localities
- identify and make funds available to assist localities in beginning wellhead protection programs which will develop a base of Virginia experience to serve as a model for other localities in the state
- assist localities by making available needed data and by providing technical assistance and coaching on technical questions - this could be done at the state level or coordinated through Planning District Commissions on a more decentralized basis.

We recommend that all localities conduct a self-assessment of the vulnerability of their public wells and test their knowledge about their jurisdiction by asking themselves a series of questions. For example:

- Do you know how many public wells are located in your jurisdiction?
- Could you locate them on a map?

- Do you know how many customers (residential, business, schools) they serve?
- Do any public wells have activities within 1/2 mile that might pose a threat (e.g., landfills, underground tanks, waste lagoons, chemical businesses, septic tanks)?
- Does the Planning Commission have knowledge of the existence of public wells when making zoning decisions?

A proposed questionnaire with more than a dozen such questions is attached to this report.

We also recommend that each locality receive a listing with locations of all public wells in their territory and that they map these. This map and its implications should be discussed with the local Planning Commission and governing body and incorporated with wellhead protection goals and objectives as part of the next revision of the locality's comprehensive plan.

We recommend that each community establish a work plan and priorities for phasing establishment of protection areas and land use controls. Priority might go to community wells, those serving the largest number of customers, those found to be most vulnerable or those for which replacement options are least available. For guidance localities would draw on the proposed report "Wellhead Protection: Tools for Local Governments in Virginia."

We see two objectives as most important at this point: getting started and building a base. In a diverse state like Virginia, flexibility is important - especially under the current fiscal constraints facing both the state and local governments. We also see wellhead protection as playing an important role as part of a larger long term groundwater resource protection and conservation effort. For many localities groundwater will play a growing, rather than a diminishing, role in their future public service and development plans. It is essential to localities, therefore, that this resource be protected. We hope that we have provided ideas that can further this goal.

## FINDINGS & DISCUSSION

### A) Planning, Zoning, and Other Local Tools as the Basis for Wellhead Protection

No other question is more central to this Committee's undertaking than the question of the legal authority for localities to engage in wellhead protection.

**We find that the Virginia statutes governing planning and zoning do provide a sufficient basis for localities to establish wellhead protection programs.**

The ability to control land uses through planning and zoning lies at the heart of any successful wellhead protection program. In Virginia, as elsewhere, the planning and zoning power rests with local government. The **Groundwater Protection Strategy for Virginia** recognizes this fact.

Local governments engage in a variety of planning, land use, and public facility siting and management activities which are unique and not duplicated by federal or state governments. These local activities that allocate land for particular uses have considerable importance in preventing groundwater degradation and protecting groundwater users. (p.53)

Following the completion of the **1987 Strategy**, the state enabling acts for planning (Chapter 15.1, Article 4) and zoning (Chapter 15.1, Article 8) were amended to indicate that localities shall study matters such as groundwater and geology in preparing their plan and may adopt provisions in their plans and zoning ordinances to protect the groundwater resource. These sections of the code now read as follows:

#### **Article 4 - The Comprehensive Plan**

S. 15.1-447. Surveys and studies to be made in preparation of the plan:  
(1) In the preparation of a comprehensive plan, the local commission shall survey and study such matters as the following: (a) Use of land, preservation of agricultural and forestal land, production of food and fiber, characteristics and conditions of existing development trends of growth or changes, natural resources, **groundwater**, surface water, **geologic factors**, population factors, employment and economic factors, existing public facilities, drainage, flood control and flood damage prevention measures, transportation facilities, the need for affordable housing, and any other matters relating to the subject matter and general purposes of the comprehensive plan . . .

S. 15.1-446.1 - Such plan, with the accompanying maps, plats, charts, and descriptive matter, shall show the commission's long-range recommendations for the general development of the territory covered by the plan, including the location of existing or proposed recycling centers. It may include, but need not be limited to:

1. The designation of areas for various types of public and private development and use, such as different kinds of residential business, industrial, agricultural conservation, recreation, public service, flood plain and drainage, and other areas;
2. The designation of a system of transportation facilities such as streets, roads, highways, parkways, railways, bridges, viaducts, waterways, airports, ports, terminals, and other like facilities;
3. The designation of a system of community service facilities such as parks, forests, schools, playgrounds, public buildings and institutions, hospitals, community centers, waterworks, sewage disposal or waste disposal areas, and the like;
4. The designation of historical areas and areas for urban renewal or other treatment;
5. **The designation of areas for the implementation of reasonable groundwater protection measures.**

## Article 8 - Zoning

§ 15.1-489. Purpose of zoning ordinances. - Zoning ordinances shall be for the general purpose of promoting the health, safety or general welfare of the public and of further accomplishing the objectives of §15.1-427. To these ends, such ordinances shall be designed to give reasonable consideration to each of the following purposes, where applicable: (1) to provide for adequate light, air, convenience of access, and safety from fire, flood and other dangers; (2) to reduce or prevent congestion in the public streets; (3) to facilitate the creation of a convenient, attractive and harmonious community; (4) to facilitate the provision of adequate police and fire protection, disaster evacuation, civil defense, transportation, water, sewerage, flood protection, schools, parks, forests, playgrounds, recreational facilities, airports and other public requirements; (5) to protect against destruction of or encroachment upon historic areas; (6) to protect against one or more of the following: overcrowding of land, undue density of population in relation to the community facilities existing or available, obstruction of light and air, danger and congestion in travel and transportation, or loss of life, health, or property from fire, flood, panic or other dangers; (7) to encourage economic development activities that provide desirable employment and enlarge the tax base; (8) **to provide for the preservation of agricultural and forestal lands and other lands of significance for the protection of the natural environment**; (9) to protect approach slopes and other safety areas of licensed airports, including United States government and military air facilities; and (10) to promote affordable housing. **Such ordinances may also include reasonable provisions, not inconsistent with applicable state water quality standards, to protect surface water and groundwater as defined in § 62.1-44.85 (8).**

Because of the addition of this language in 1988 and in 1990, the Dillon's Rule principle that actions not expressly authorized or implied are prohibited does not appear to be a significant constraint. Wellhead



protection, on the contrary, would seem to be exactly the type of program envisioned when the state enabling laws were amended. Wellhead planning and zoning measures - as long as they meet the standards generally used to judge the legality of planning and zoning measures in Virginia - should be considered valid.

We do note the term "reasonable" in the above statutes but we do not believe that this places a significant cloud over the conferred authority because all planning and zoning must stand a test of reasonableness. Generally this means zoning in accord with a plan, restrictions and boundaries that are justifiable, provision for continued use of the property, treating similar properties alike, etc. We also observe that the statutory zoning language makes groundwater protection optional rather than mandatory. Zoning itself, however, continues to be optional in Virginia so such a feature is not inconsistent with the spirit with which all zoning is approached in this state. Over the years more and more Virginia localities have come to implement zoning and it might be expected that zoning for wellhead protection might evolve in a similar way if other obstacles are overcome.

Looking beyond the general question of whether zoning for wellhead protection is authorized, we have also examined the question of the most appropriate form which that zoning might take.

**We find that overlay zoning for wellhead protection is the most appropriate approach.**

A clear parallel exists between overlay zoning for wellhead protection and overlay zones that exist in localities around Virginia for surface water reservoir protection. Albemarle County, James City County, Spotsylvania County, Fairfax County, and York County for instance, have opted to protect their surface watersheds in this way. Clarke County has adopted a Natural Resource Protection Overlay Zone to protect the recharge area around the Prospect Hills Spring which serves as the source of the Clarke County Sanitary Authority's Boyce-Millwood Public Water System. At the present time this is the only example of which we are aware in Virginia of an existing wellhead protection ordinance. Studies expected to lead to such zoning, however, are underway in Accomack and Northampton Counties and Loudoun County. In reviewing examples of wellhead protection ordinances from around the country, we found overlay zoning to be the most common method for achieving wellhead protection.

Another important question is how best to deal with situations where pre-existing uses pose a potential threat to groundwater. The conventional approach in zoning is to consider such uses grandfathered allowing them to continue indefinitely as non-conforming uses. Amortization - mandatory phasing out of nonconforming use - is not a widely employed practice in Virginia. We believe, however, that an approach which mandates installation of specified best management practices or performance standards for continuing non-conforming uses would be judged reasonable and would recommend this approach to localities. To a degree this is already taking place since the state now requires that old underground storage tanks be replaced with new tanks meeting higher safety standards. This is being phased in and is scheduled for completion by 1998.

In addition to planning and zoning, we also point out that other local powers (subdivision controls, capital improvements, public facilities, performance controls, use value taxation, or other devices) can be available at the discretion of local officials to achieve wellhead protection. While specific groundwater language has not been added to the state code for these tools, it is generally the case that their exercise is required to be consistent with the comprehensive plan and zoning. Thus the planning and zoning language provides the link to groundwater for these tools. Reference books prepared by EPA (Wellhead Protection Programs: Tools for Local Governments) and by the Virginia Water Resources Research Center (Protecting Virginia's Groundwater: A Handbook for Local Government Officials) illustrate ways that the full array of local decisions can be utilized with groundwater protection as an objective.

In summary, we find that the major obstacles to widespread adoption of local wellhead protections do not so much involve questions of adequate legal authority but instead involve other issues - issues related to public awareness, technical complexity, availability of information, and staffing/cost issues. We turn our attention now to these issues.

## **B) Public Awareness and Support for Wellhead Protection**

Without public support it is unlikely that significant regulatory or spending decisions will be made. Does this support now exist for wellhead protection?

We find that citizens, business leaders, and officials in Virginia are not generally aware of the extent of the potential problem surrounding public water supply wells, or of their options for addressing these through wellhead protection. Without this awareness, public support has not yet developed.

Virginia communities are fortunate not to have experienced widespread or serious pollution of public wells to the degree that some communities in other states have. In those unfortunate cases, wellhead protection emerged and gained rapid momentum as a response to real and immediate crises. With hindsight, those communities began taking actions to prevent recurrence. Virginia can learn from their experience.

With the exception of a few pioneering localities such as Clarke and Loudoun Counties and the Lord Fairfax and the Accomack-Northampton PDC's which have either ordinances in place or studies underway, wellhead protection is still a new concept in Virginia. A number of localities such as those represented on this Committee have shown interest in learning more about wellhead protection and in several cases have amended their plans and are seeking funding to conduct initial studies. Generally, however, public awareness and, therefore, potential support for wellhead protection does not yet exist in the majority of the state.

It cannot be said that communities in Virginia have no experience with pollution of public water supply wells. Anecdotal data brings out several cases. For instance, in 1985, Prince William County found that one of its public wells contained perchloroethylene. The IBM plant at Manassas approximately a mile away was detecting the same chemical. Since then this well has been taken off line and IBM and the County have been pumping it heavily, treating the water through carbon filtration and discharging the treated water into the municipal sanitary sewer system. Several years ago, the Town of Berryville in Clarke County lost its main public water supply well when it was found that the water contained excessive levels of nitrates. The town, at an expense of \$1.3 million replaced that well by constructing a water treatment facility using the Shenandoah River. Agricultural practices were believed to be the source of the problem. The Town of Fincastle found that it could not rely on groundwater within the town for its public water supply due to contamination from residential septic tanks and hydrocarbons from leaking underground storage tanks and has subsequently drilled two wells located in Botetourt County. The town is working with the county to see if some sort of wellhead program can be put in place to prevent future

problems. Fortunately for Virginia, it still appears to be the case that these are scattered examples.

Moving beyond anecdotal data, there is very little systematic data currently available about problems with public wells. It is understandable that communities are reluctant to publicize their experience with groundwater pollution because doing so could be seen as a criticism or as hurting the area's economic development potential. Nevertheless it is important to begin to document any such problems so that communities can learn from each other's experience.

Another reason for the lack of awareness comes from the need to improve the ways that data are collected, compiled and made accessible. Much raw data already exists and more will be reported in the coming months as stepped up monitoring is required by the Safe Drinking Water Act. It is also essential that improvements be made in the submission and filing of water well completion and well abandonment reports. Geographic information systems (GIS) are only beginning to be established by the state and it will be some time before field offices are able to enter, debug and make use of data that now exists in file cabinets. Such data, once systematized, can provide much needed information as well as valuable early warning. For instance, initial data has been placed on a data base regarding volatile organic chemicals (VOCS) - chemicals such as toluene, benzene, trichloroethylene, and perchloroethylene. This early data shows that some two dozen systems - including schools, city systems, as well as a variety of public/private facilities - have turned up detectable levels of a variety of VOCS. In many cases this is the result of leaking underground storage tanks or poor well construction. Fortunately, these measurements are at this time below the level of maximum contaminant levels so they are not technically violations and are not seen as posing immediate health problems. Even low levels of these chemicals, however, indicate that there is a pathway, a connection, between nearby land use activities and groundwater being pumped for public water supply.

This Committee is concerned that with the current budget cutbacks that important data will not be able to be managed as it needs to be and that quality as well as accessibility will suffer. Our concern grows with the increase in data to be managed in the coming months and years. This intensified monitoring seems likely to turn up previously unknown problems and it is essential that patterns be identified as quickly as possible. Gradually we expect public awareness to grow. Until better documentation exists there is understandable reluctance on the part of elected officials to impose new regulatory programs and to spend limited

funds on an unfamiliar program absent a clear problem or a public demanding action.

### **C) Diversity Among Virginia's Localities**

Localities across Virginia vary considerably - physically, economically, and politically. Some rural localities still do not have zoning, for instance, and these can be the same communities relying exclusively on groundwater. How significant a factor is Virginia's diversity for wellhead protection?

**We find that the state's physical, economic and political diversity, all point to the conclusion that no one wellhead protection approach will be best for all locations. At the same time, we find that a variety of methods do exist and have been successfully used in communities around the country and can serve as models.**

The premise of wellhead protection is that potential pollutants which might be released at the surface of the ground may find their way over time into the groundwater. Depending on factors like the depth and construction quality of the well, the amount of water withdrawn each day, the geology and hydrology of the zone around the well and the type of pollutant released, the well might become polluted. Each of these factors is important but none more so than the hydrogeologic environment of the well.

Virginia can be divided into five distinct hydrogeologic environments - the Coastal Plain, the Piedmont, the Blue Ridge, the Valley and Ridge province and the Cumberland Plateau. The connection between groundwater and the surface is relatively clear in the fractured rock of Piedmont, along the alluvial "western toe" of the Blue Ridge and in the sedimentary Cumberland Plateau province. However, in the Coastal Plain where public wells are in deep confined aquifers, and in the karst limestone terrain of the Shenandoah Valley, delineating wellhead protection areas is more difficult.

The issue in the confined aquifer area is that the several overlying confining layers provide a considerable buffer of protection from the surface. Public wells in this area can run to a depth of 500 ft. Possible breaks in confinement, infiltration from poorly constructed or abandoned wells or gradual infiltration from overlying shallow aquifers could

introduce pollutants into deep public wells. Because of heavy pumping, vertical recharge is now believed to be a more significant factor than had previously been assumed. These regional considerations make it difficult to know how to define an immediate protection area around the well bore site and to know the degree to which such measures are needed or will prove effective. The safest approach in the Coastal Plain we feel, is a combination of localized wellhead protection, evaluation of the integrity of existing wells, attempts to locate and seal abandoned wells and area-wide efforts to prevent industrial accidents and other potential sources of pollution. Wellhead protection areas per se may play a smaller role than in other parts of the state.

In the karst area where there can be underground conduits with relatively rapidly moving waters, it is also difficult to know whether protecting the area in the immediate vicinity of the well will be adequate. Water could come from many miles away. Careful mapping and hydrogeologic studies may be required to determine the extent of such contributions. We feel that it is still desirable, though, to protect the area in the vicinity of the well because one can be relatively certain that pollutants released nearby would find their way into the groundwater. What is less certain is the degree to which other areas could contribute additional pollution. In the karst area, we feel that wellhead protection has a role to play but that it alone may not be sufficient.

We also find that Virginia localities are diverse in terms of the ways in which they utilize groundwater to meet their public water supply needs. Among the jurisdictions found on this Ad Hoc Wellhead Advisory Committee, for instance, we find one jurisdiction that has no county owned systems but contains a large number of investor owned systems. Another locality has its municipal wells located in an adjoining jurisdiction. Several areas are in the process of connecting small subdivision systems to the county surface water based system and taking them off groundwater. A number of areas, and this is significant, see groundwater as a permanent and a growing part of their municipal water supply system and see the need to protect this possibly irreplaceable resource.

Depending on the number, ownership, size and hydrogeologic characteristics of the public wells in a jurisdiction, one or another wellhead protection strategy might make the most sense for that particular locality. The challenge this presents is keeping multiple possibilities open, moving forward where there appears to be opportunity

and encouraging those who are less far along. It also means that there will be a substantial need for technical assistance and guidance.

#### **D) Land Use Options in Wellhead Protection Areas**

If a locality is interested in wellhead protection then what options do they have in terms of regulatory boundaries and the types of restrictions to employ? Are there examples that illustrate different approaches?

**We have reviewed the approaches taken in a number of communities in other states and find that the key decisions are**

- **whether to delineate a single primary wellhead protection area or whether to establish a series of tiered areas (primary, secondary, etc.)**
- **whether to base regulations on general land use categories or on specific chemical substances utilized on site**
- **which, if any, land uses or substances to prohibit and which to allow subject to conditions**
- **what, if any, performance standards or BMP's to require**

The decision about delineating one area or several reflects a choice between keeping matters as simple as possible or taking a more refined approach based on recognition that risk changes as one moves further from the well. For instance, a land use that should be prohibited one hundred feet from the well might be allowed under certain conditions if it were one half mile away. Delineating several tiers allow such distinctions to be taken into account.

The choice of basing regulations on land use categories or a list of substances of concern depends to a considerable degree on the type of land use anticipated in the wellhead protection area and staff capability. If industrial uses already exist or are expected, a substance based approach aimed at safe use, monitoring and emergency planning, may be the most appropriate. In an area where residential septic tank and/or agricultural practices are of primary concern, a more generalized land use approach might be chosen.

What land uses to allow by right, to allow conditionally or to prohibit altogether will be influenced by the size of the area being protected and whether a tiered approach is used. Many jurisdictions studied assigned high risk to various waste disposal practices, hazardous material use, underground storage tanks, petroleum pipelines and residential septic tanks and prohibited these in their primary protection area within a few hundred feet of the well but allowed them with conditional approval in secondary protection areas some distance removed.

Performance standards addressing containment practices, clean up capability, emergency planning, monitoring, etc. can be used in conjunction with the other options above to assure that operations are conducted safely. These measures work best, as might be expected, when monitoring and compliance checking are undertaken systematically. We have examined performance standard examples from a variety of communities and these could be compiled as references for Virginia localities.

Virginia is a diverse state and different land use regulatory approaches may be best for different areas. Options need to be made available and pointed out to local governments. Some will want to start simply, others may want to evolve and others may be looking immediately for the most advanced approaches. At this point in Virginia, however, wellhead protection is a relatively new idea and so examples of the full range of options need to be provided as part of an educational effort.

#### **E) Cost and Staffing Issues**

Issues of cost are always a paramount consideration but especially so in light of the budget situation facing both state and local governments in Virginia at this time. Can we afford wellhead protection or, put the other way around, can we afford not to have wellhead protection?

Based on the reports which we have been able to examine, we find that a strong argument can be made in cost benefit terms for wellhead protection. Few Virginia localities, however, have undertaken a careful assessment of their vulnerability or the cost implications if a problem were discovered.

Clarke County Virginia is an exception to this statement. They hired a consultant to conduct a cost-benefit analysis of protecting a 300 ft.



area around the Prospect Hill Spring. Three alternatives were examined - transport of Shenandoah River water, extension of transmission mains to purchase of water from the Town of Berryville, or treatment of the current Prospect Hill or another spring source. Based on the analysis at that time, the value of the Prospect Hill Spring was estimated to be approximately \$700,000 and the benefit to cost ratio was found to be 3 to 1 or greater.

Studies conducted in Minnesota estimated that groundwater pollution there cost the 35 cities surveyed over \$67 million and in many cases the cost of clean up continues. Evidence was found to suggest that a wide range of economic problems can be encountered - devalued real estate; diminished home sales or commercial real estate sales; relocation of commercial development; loss to the tax base; consulting and legal fees; increased operation and maintenance costs; and increased water rates, as well as the cost of new equipment, treatment, and direct cleanup. While there is some debate about whether the costs of prevention, given the high probability that most wells will not become polluted, are less than the cost of remediation, the Minnesota study concludes that "In all cases, prevention of groundwater contamination would have been more cost effective than groundwater cleanup."

In Virginia, it is our belief that communities have not been aware of or thought a great deal about their groundwater supplies. Many, if not most, localities are probably not aware of the number, location or types of public wells located in their jurisdictions. The planning department and those involved with land use decisions may not be as aware of wells as their service authority or their health department. Most likely to be known are the one thousand plus community wells in the state serving residential customers, subdivisions, mobile home parks, nursing homes or correctional facilities. Only one-third of all community wells, however, are municipally owned. Two-thirds are investor owned and probably not well known to governmental decision makers. In addition, there are approximately fourteen hundred non-community water works serving the transient public at campgrounds, motels, restaurants and highway rest areas and an additional four hundred public wells serving schools and factories. We believe that few communities have assessed cost issues either of protecting these wells or of replacing them in the event of contamination.

The Health Department projects that a significant number of public water supply systems are likely to require some sort of upgrading in the next few years as a result of the SDWA requirements. In a 1990 report to

the state legislature, the Health Department estimated that 935 systems will require disinfection, 234 will need treatment for synthetic organic chemicals, 144 for trihalomethane, 24 for total coliform, 148 because they are springs, 782 for radionuclides, 610 for lead and copper. The costs of these modifications will not be insignificant. If they could to any degree be avoided or reduced by better wellhead protection, it could prove quite valuable.

There is also, we should note, some indirect financial incentive for localities to delineate and protect wellhead areas. When the full force of the Safe Drinking Water Act comes on line, the costs of water sampling and monitoring could be substantial. Many feel that small systems may have to hire consultants to do this work. A community which has a wellhead protection program and has studied land use patterns in that area can petition the Health Department to waive certain monitoring requirements on the basis that the well is not vulnerable to that particular pollutant.

Published estimates of the costs for delineating wellhead protection areas vary widely from a few hundred to several thousand dollars depending on the sophistication of the method employed, the number of wells being delineated and the availability of basic data. One local government official on our committee felt that too much was being made of the difficulty and costs of delineating wellhead areas using the available methodologies. He experimented with several trial calculations and concluded that much of the data needed can be found by searching in the files of the county or the State Health Department. He found sufficient data which, along with some assumed values based on textbook tables and known geologic conditions in the area, allowed calculations to be made. He also concluded that in the absence of such data it would likely be possible for under \$2000 to conduct a television camera survey of the well shaft to learn about subsurface conditions and to run new pump tests for a day or more to come up with the data necessary for basic calculations. We judge this to be a very reasonable cost in light of the potential benefits.

Many localities lack the technical skill needed for wellhead delineation. One option would be for the state to delineate all the wells in the Commonwealth. Another would be for the state to provide at least some level of technical assistance, data and seed money funding to at least some localities. In order for the state to carry out this approach, however, they too will need additional funding and staff. Hiring consultants would be one way for localities to proceed. Another would be

to develop basic wellhead expertise at the PDC level in order to serve the needs of several localities while benefitting from some economies of scale. EPA provides training workshops, software for computer application and a variety of technical handbooks which could assist in developing in-state expertise at both the state and local levels.

. . . . .

Localities in Virginia have a need for wellhead protection. The legal authority exists for them to do so. Initiating a new program, however, unavoidably involves start up costs and a learning curve. We believe that left entirely to their own devices - given the level of awareness that exists, the diversity of the state's geology, the lack of instate examples of wellhead management practices, and costs and staffing issues - local governments in Virginia will be slow to undertake wellhead protection on a widespread basis. The question is how to begin getting over the obstacles which stand in the way of instituting local wellhead protections.

The following recommendations are offered as a way of addressing this need.

## RECOMMENDATIONS

1. **We urge local governments in Virginia to exercise the option to use their planning and zoning powers to establish local wellhead protection programs.** We recognize that a state mandate that all local governments institute wellhead protection would have a number of potential advantages - more rapid start-up, uniformity from one locality to the next, less need to persuade officials of the need for such a program, etc. However, with the low level of public awareness at the present time, limitations on the adequacy of the state's data base, and the lack of funding, we do not feel that it is timely for a mandatory program. We recommend instead that a voluntary approach be taken, at least in the short term, while a base is built for a possibly more widespread mandatory wellhead protection program in the future.
2. **We recommend that the state take the lead in placing wellhead protection on the public agenda, in improving the groundwater database, and in building capacity both within state government and at the local and PDC levels.** We recognize that the state government has greater technical expertise, better access to important data and has been assigned the role of overall leadership for groundwater resource protection. We also feel that PDC's offer an intermediate level of government with potential to play an important role in wellhead protection if they were to be financially and technically able to develop the necessary expertise.
3. **We recommend that the roles of the Water Control Board and the Department of Health in wellhead protection be clarified and spelled out so that local governments can know who to turn to for data, for technical assistance of various types, for potential funding, etc.** Many agencies of state government have something to do with groundwater protection and this is the reason for the creation of the inter-agency Groundwater Protection Steering Committee, with the Water Control Board as its chair, in 1986. The Office of the Governor has also designated the VWCB as the lead agency in wellhead protection but at the same time the Department of Health has responsibility for managing the public water supply program under the Safe Drinking Water Act and has access to much of the data needed for delineation and monitoring. More clearly expressed lines of responsibility need to be provided.
4. **We recommend that the state, under Groundwater Protection Steering Committee auspices, prepare and issue a**

**report and recommend courses of action addressed to local governments on the topic of wellhead protection. This report should also be used as the basis for organizing discussions, workshops and other outreach efforts similar to those which followed earlier Steering Committee reports. This report should discuss the nature of the threat to public water supply wells; be a primer on groundwater sufficient that a layman can understand the strengths and weaknesses of protecting wellhead areas; show how planning, zoning and other tools of local government can be used for wellhead protection; indicate how needed data, technical assistance and seed money funding can be pursued and offer a set of delineation prototypes which could be adopted by localities in the absence of site specific local studies. These areas should be relatively compact and should be viewed as a first step in wellhead protection.**

**5. We recommend that the state undertake to identify and, as soon as possible, make available sources of funds which could be used to support local wellhead protection studies and management proposals. Where federal monies - for instance, 106 and 604B monies from the Clean Water Act or 319 Non-point Pollution or Coastal Zone program funds - are administered by the state, we recommend that a share of these be devoted to wellhead protection. State programs such as the Chesapeake Bay Local Assistance Department monies and the Virginia Resource Authority should also be examined. Not only would pilot study localities receiving funds benefit directly but the state and other localities would benefit from having a number of Virginia case studies to serve as examples. We recognize that funds are limited but feel that a beginning can be made now and then added to in the future when fiscal conditions ease. We recommend that additional monies be sought to support both state and local wellhead protection efforts over the long term.**

**6. We recommend that means be explored to improve the availability and the quality of public well construction, log and pump test data since these are an indispensable part of the base which needs to be built before widespread adoption of wellhead protection practices can occur. We are optimistic that the Health Department, working with well drillers and owners can provide an improved data base that would help with wellhead protection area delineation if that purpose is explicitly addressed in applications for future wells.**

7. **We recommend that renewed effort go into groundwater resource characterization studies.** Studies which describe areawide and regional characteristics are important in understanding hydrogeologic conditions and trends so that more accurate assumptions and expectations can be factored into wellhead protection efforts.

8. **We recommend that the state provide technical assistance to localities for conducting necessary delineation or other studies rather than the state itself actually doing delineation.** The state should act as a technical resource, a source of ideas, a facilitator, and a coach to provide assistance to localities and to PDC's.

9. **We recommend that all state agencies issuing environmental permits or operating facilities within designated protection areas make information available to localities about these permits or facilities.** We also recommend that with regard to future permits or facilities within designated wellhead protection areas, state agencies give local government early opportunity to offer comments, concerns or suggestions in addition to certifying that the proposed use does or does not comply with the applicable zoning. We believe that this sort of early state-local interaction is essential in meeting the purposes of wellhead protection.

10. **We recommend that local governments play the lead role in setting protection goals and priorities, in determining areas to be protected, and in designating the type of protections to be implemented for both existing and future public wells.** We propose as a first step that each local government in the state ask itself a series of questions to test their groundwater awareness, to focus attention on potential threats, to identify options for preventive measures, and to evaluate replacement options if a public well were to become unusable. A proposed questionnaire is attached as an Appendix.

11. **We recommend as a second step that each local government map the location of each public well in its territory.** We request that the Department of Health provide each locality with a listing and location for each public well in their jurisdiction. We recommend that the map and its implications be discussed with the Planning Commission and the governing body of each jurisdiction.

12. We recommend as a third step that each locality incorporate this map and the outcome of its discussions into the next revision of their comprehensive plan. The plan should specifically spell out goals and objectives with respect to public water supply wells as addressed in Chapter 15.1, Article 4 of the Virginia Code.

13. We recommend as a fourth step that each locality establish a work schedule and priorities for implementing the goals and objectives of their plan. Jurisdictions may want to phase their activities and to have a work plan geared initially to the highest priority wells. These might be community wells, those with the largest number of customers (residences, business, schools, etc.), wells judged to be the most at risk, wells which would be the most difficult to replace if they were lost, or municipally owned wells where protecting the investment of public funds is paramount. Whatever it might be, we strongly recommend that some set of priorities be adopted.

14. Rather than recommending one specific set of land use regulations, we recommend that each locality make that choice and that they do so informed by the options which will be identified in the proposed report "Wellhead Protection: Tools for Local Governments in Virginia." At the minimum we recommend each locality establish a primary protection area for a given well and a set of land use based regulations to protect the immediate area around the well bore.

15. In addition to planning and zoning, we recommend that localities review the other tools available to them to see whether there are additional opportunities to achieve the objectives of wellhead protection in a coordinated overall program. It is generally agreed that when more than one tool is used, the strengths of one compensate for weaknesses of another and that combined efforts gain their greatest strengths.

16. We recommend that localities adopt policies for the siting of new public wells and work with state agencies in order to achieve coordinated state/local, land use/public service decisionmaking and take advantage of the opportunity to anticipate and prevent problems before they occur. "Anticipate and prevent" are key terms in Virginia's 1987 Groundwater Protection Strategy and should also guide wellhead protection efforts in the state.

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The above recommendations are offered as a way of getting started in Virginia by building from the bottom up. The recommended approach will give time to build a base of public awareness, improve data and technical understanding and identify funding needed in the long run for a sustained effort. We have seen from the experience with the Chesapeake Bay that it takes years to build the base upon which new land use programs can rest. Once that base was established for the Bay, we saw that major initiatives became possible.

Our recommendations recognize that a period of learning is needed and we believe our proposals will reap benefits in the long run. We find much in common between our recommendations and the elements making up EPA's recommended approach to wellhead protection. Both approaches are aimed at many of the same underlying objectives.

We urge the reader to give our findings and recommendations serious consideration.



## Appendix A SELF-ASSESSMENT QUESTIONNAIRE

"Out of Sight - Out of Mind" is a phrase often used to describe people's attitudes toward groundwater. The goal of wellhead protection, however, is to bring public water supply wells into sharper focus so that they can be protected for continued beneficial use. Chapter 15.1 Article 4 of the Virginia Code indicates that localities shall study or survey groundwater, geology and other factors in preparing and amending their comprehensive plan. In beginning that process, the following questions can help you decide how well informed you are and how well prepared your jurisdiction is to protect its public groundwater supplies.

	Yes	No
1. Do you know how many public wells are located in your jurisdiction?	—	—
2. Could you locate them on a map?	—	—
3. Do you know how many are owned by local government and how many are owned by investors or others?	—	—
4. Do you know which wells pump the greatest quantity of water?	—	—
5. Do you know how many people they serve?	—	—
6. Do you know how many wells serve businesses or industry?	—	—
7. Are there contingency plans in place for the event that any of these wells might become polluted?	—	—
8. Have any public wells required treatment as a result of testing under the new Safe Drinking Water Act amendments?	—	—
9. Have any public wells in the past been closed due to contamination?	—	—
10. Do any public wells have activities within 1/2 mile that might pose a threat (e.g., landfills, abandoned wells, underground tanks, waste lagoons, chemical, businesses, septic tanks)?	—	—
11. Under current zoning, could such activities locate there in the future?	—	—
12. Does the planning commission have knowledge of the existence of public wells when making zoning decisions?	—	—
13. Do you have knowledge of the underlying geology and feel confident that the flow of contaminated groundwater would not be in the direction of a public well?	—	—
14. Are you familiar with the authority under chapter 15.1 of the Virginia Code for localities to adopt measures to protect groundwater?	—	—
15. Could a problem with the water quality in any of the public wells in your locality have a negative impact on economic development?	—	—

If more than a few questions are answered "No," then your jurisdiction should consider further studies of its public wells and consider adopting wellhead protection measures.